

# FreedomCAR: Energy Security for America's Transportation

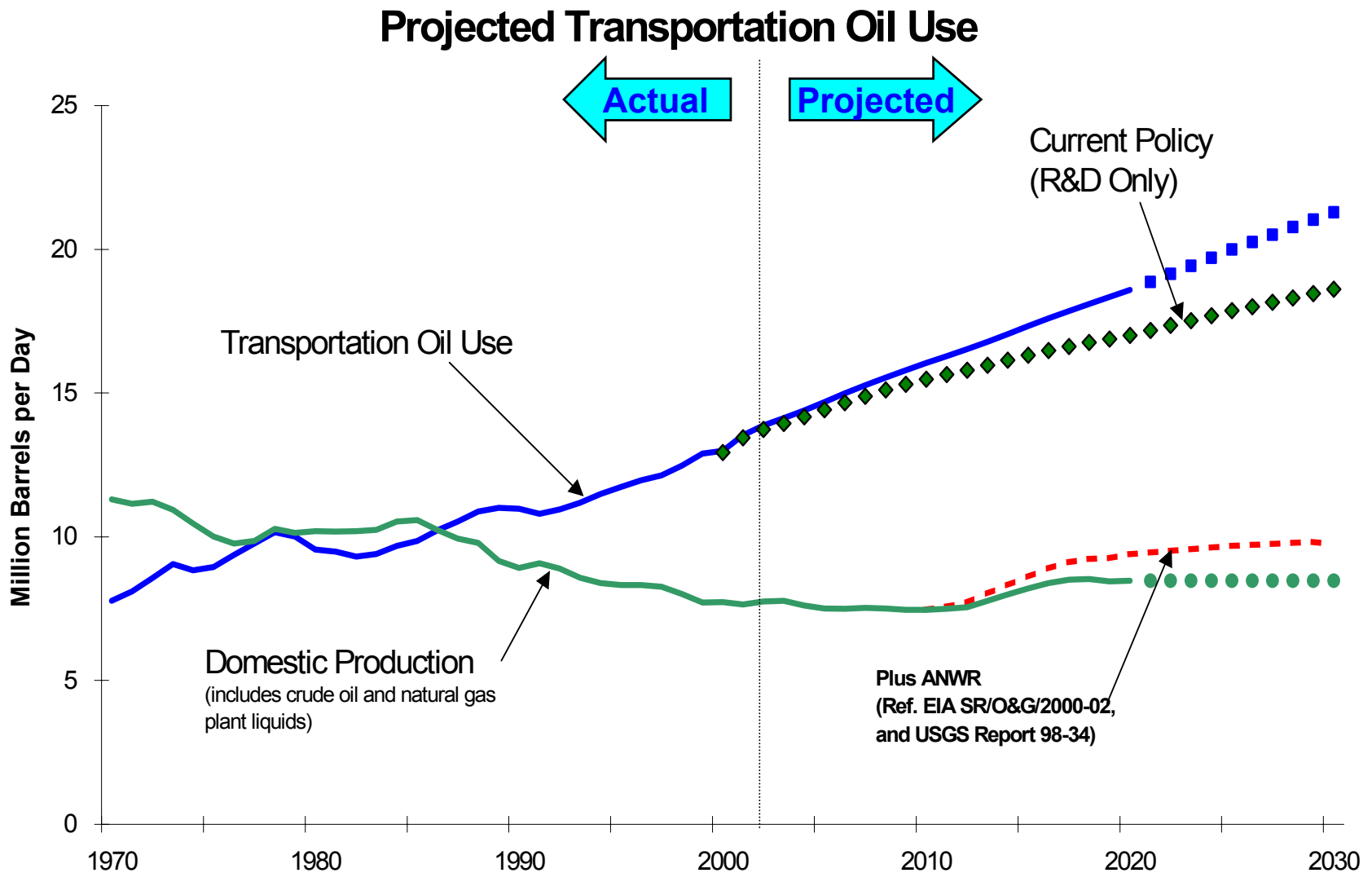
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# The "Gap" Is Growing



# FreedomCAR Is a Partnership



- Secretary Abraham joins with leaders of General Motors, DaimlerChrysler, and Ford in announcing FreedomCAR at the North American International Auto Show in Detroit on January 9, 2002.

# FreedomCAR

- CAR = Cooperative Automotive Research.
- Freedom:
  - Freedom from petroleum dependence;
  - Freedom from pollutant emissions;
  - Freedom for Americans to choose the kind of vehicle they want to drive, and to drive where they want, when they want; and
  - Freedom to obtain fuel affordably and conveniently.

# Strategic Approach

- Develop technologies to enable mass production of affordable hydrogen-powered fuel cell vehicles and assure the hydrogen infrastructure to support them.
- Continue support for other technologies to dramatically reduce oil consumption and environmental impacts.
- Instead of single vehicle goals, develop technologies applicable across a wide range of passenger vehicles.

# NAS Observations and Recommendations

- “[T]he priorities and specific goals of the PNGV program should be reexamined. There is a need to update the program goals and technical targets in the context of current and prospective markets ... government and industry participants should refine the PNGV charter and goals.”
- “[T]he demand for sport utility vehicles, vans, and pickup trucks in the United States has drastically increased ... This has increased the importance of reducing the fuel consumption of these vehicles compared to the typical family sedan.”

# NAS Observations and Recommendations

- “If the program goal(sic) were refocused on reducing total new light duty vehicle petroleum consumption, this would encourage the emphasis to be placed on those vehicles that offer the greatest potential for achieving this societal goal.”
- “...it is inappropriate to include the process of building production prototypes in a precompetitive, cooperative industry-government program.”

# FreedomCAR Differs From PNGV

## ➤ Different Goals:

- FreedomCAR's focus is petroleum free, emissions free transportation, with emphasis on hydrogen fuel cells.
- PNGV's focus was on demonstration of high fuel efficiency, pre-production family sedans.



# FreedomCAR Differs From PNGV

## ➤ Different Timeframe:

- FreedomCAR has a long-term vision with intermediate 2010 component technology goals to measure progress.
- PNGV time frame was focused on 2004.

# FreedomCAR Differs From PNGV

- Different Government Leadership:
  - FreedomCAR is a collaboration with USCAR led by the Department of Energy.
  - PNGV was a collaboration with USCAR led by the Department of Commerce.

# FreedomCAR Differs From PNGV

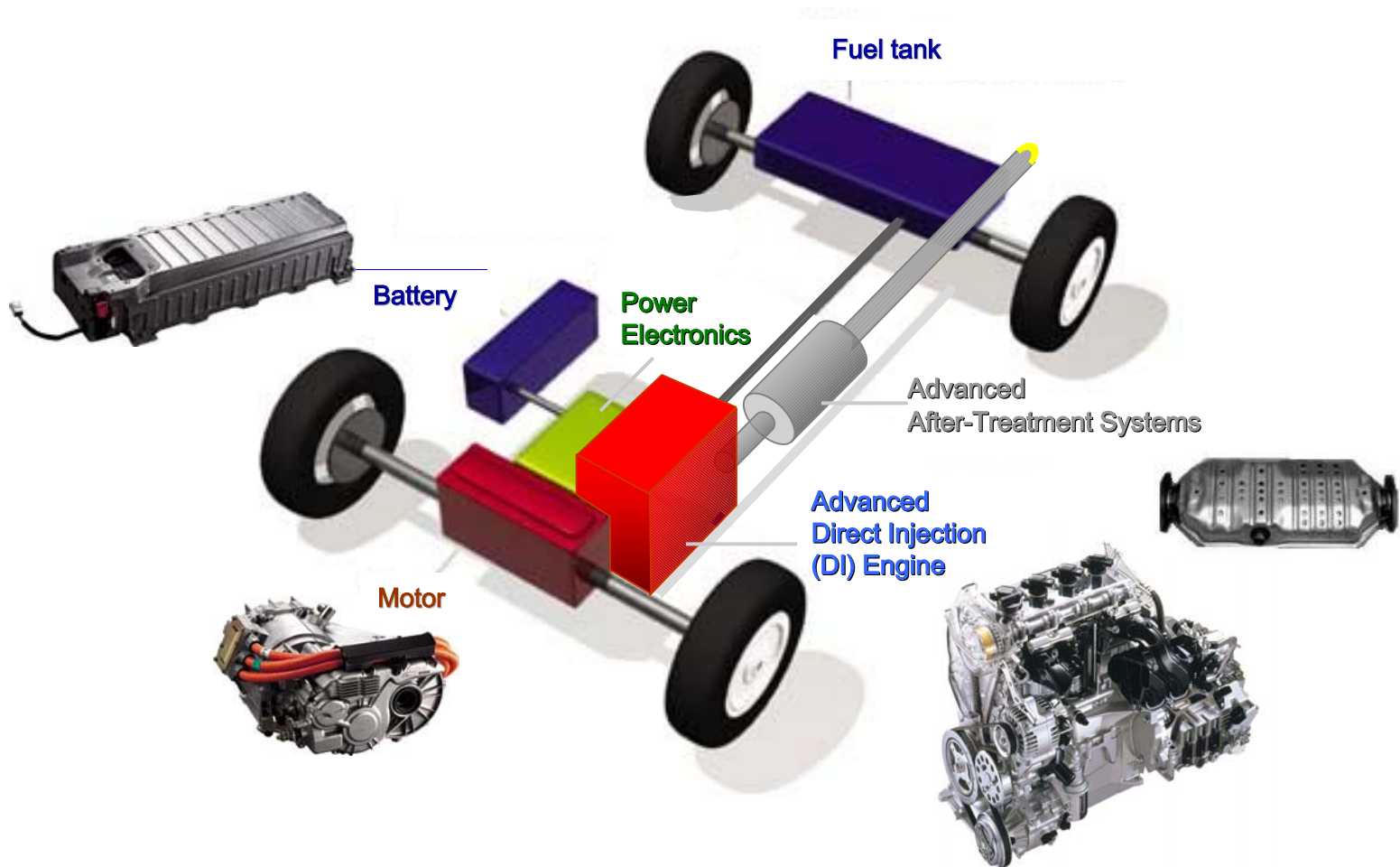
- Different Technology Emphasis:
  - FreedomCAR is focused on hydrogen and fuel cells, with transitional efficiency gains from advanced combustion and fuel processors.
  - PNGV emphasized compression ignition direct injection (diesel) hybrids.

# FreedomCAR Differs From PNGV

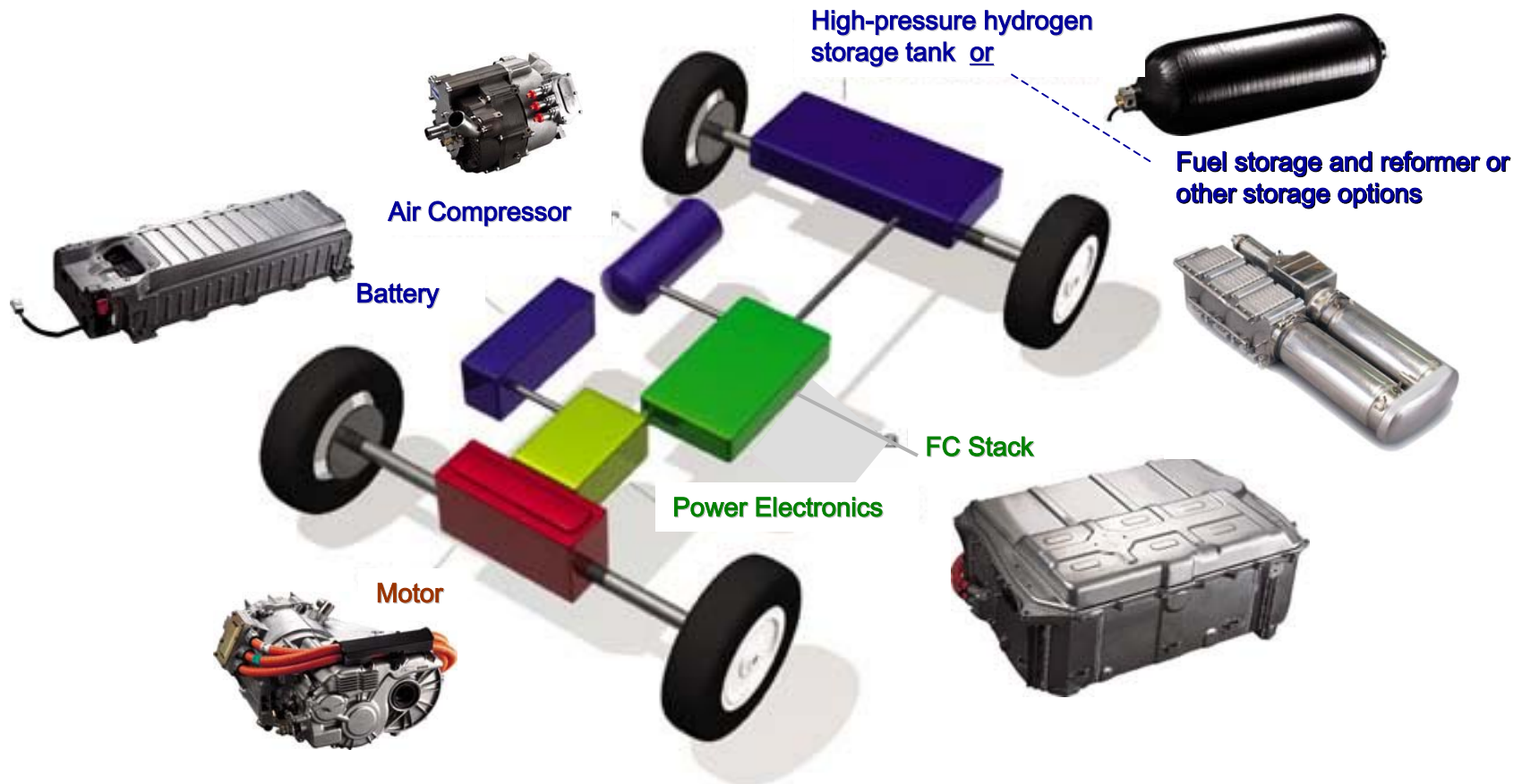
## ➤ Different Vehicle Focus:

- FreedomCAR's focus is R&D at the component level with equal emphasis on light trucks and cars.
- PNGV emphasized development and demonstration of pre-production mid-sized family sedans.

# FreedomCAR and Hybrids Share Electric Drivetrain Technology



# Fuel Cell Vehicle Components



# Budget Crosscut

	PNGV		FreedomCAR
	FY 2001 <sup>a/ b/</sup> Comparable Appropriations for PNGV Tier 1	FY 2002 <sup>b/</sup> Comparable Appropriations for PNGV Tier 1	FY 2003 <sup>b/</sup> Request
<b>Office of Energy Efficiency and Renewable Energy, Total</b>	<b><u>138,962</u></b>	<b><u>126,662</u></b>	<b><u>150,296</u></b>
<b>Transportation Sector Funding Supporting FreedomCAR</b>	<b><u>138,962</u></b>	<b><u>126,662</u></b>	<b><u>124,476</u></b>
<b>A. Vehicle Technologies R&amp;D</b>	<b><u>109,812</u></b>	<b><u>100,031</u></b>	<b><u>107,076</u></b>
1. Hybrid Systems R&D	45,060	41,615	38,500
2. Fuel Cell R&D	40,663	41,925	50,000
3. Advanced Combustion Engine R&D	22,589	15,991	14,076
4. Cooperative Automotive Research for Advanced Technologies (CARAT)	1,500	500	1,000
5. Electric Vehicles R&D			3,500
<b>B. Fuels Utilization R&amp;D</b>	<b><u>6,856</u></b>	<b><u>6,980</u></b>	<b><u>5,600</u></b>
1. Advanced Petroleum Based Fuels	5,874	5,980	5,300
2. Alternative Fuels	982	1,000	300
<b>C. Materials Technologies</b>	<b><u>21,454</u></b>	<b><u>18,851</u></b>	<b><u>10,800</u></b>
1. Propulsion Materials Technology	2,936	2,991	1,000
2. Lightweight Materials Technology	18,518	15,860	9,800
<b>D. Technology Deployment: Advance Vehicle Competitions</b>	<b><u>840</u></b>	<b><u>800</u></b>	<b><u>1,000</u></b>
<b>Hydrogen Program Funding Supporting FreedomCAR</b>			<b><u>25,820</u></b>
<b>A. Core R&amp;D</b>			<b><u>15,590</u></b>
<b>B. Technology Validation</b>			<b><u>7,900</u></b>
<b>C. Analysis and Outreach</b>			<b><u>2,330</u></b>

<sup>a/</sup> FY 2001 appropriations have been adjusted to reflect the .22% omnibus rescission and an appropriation transfer for the Small Business Innovation Research (SBIR) and the Small Business Technology Transfer Pilot Program (STTR).

<sup>b/</sup> Totals do not include administrative expenses.

# 2010 Technology Goals: Fuel Cell Powertrains

- Electric Propulsion System with a 15-year life capable of delivering at least 55kW for 18 seconds, and 30kW continuous at a system cost of \$12/kW peak.
- 60% peak energy-efficient, durable fuel cell power system (including hydrogen storage) that achieves a 325 W/kg power density and 220 W/L operating on hydrogen. Cost targets are at \$45/kW by 2010 (\$30/kW by 2015).



# 2010 Technology Goals: Hydrocarbon Fuel Platform

- Internal combustion engine powertrain systems costing \$30/kW, having a peak brake engine efficiency of 45%, and that meet or exceed emissions standards.
- Fuel cell systems, including a fuel reformer, having a peak brake engine efficiency of 45%, and that meet or exceed emissions standards with a cost target of \$45/kW by 2010 and \$30/kW in 2015.

# 2010 Technology Goal: Hybrid Systems

- Electric drivetrain energy storage with 15-year life at 300 Wh with discharge power of 25 kW for 18 seconds and \$20/kW.

# 2010 Technology Goals: Hydrogen Transition

- Demonstrated hydrogen refueling with developed commercial codes and standards and diverse renewable and non-renewable energy sources. Targets: 70% energy efficiency well-to-pump; cost of energy from hydrogen equivalent to gasoline at market price, assumed to be \$1.25 per gallon (2001 dollars).

# 2010 Technology Goals: Hydrogen Transition

- Hydrogen storage systems demonstrating an available capacity of 6 weight percent hydrogen, specific energy of 2000 W-h/kg, energy density of 1100 W-h/liter at a cost of \$5/kWh.
- Internal combustion engine powertrain systems operating on hydrogen with a cost target of \$45/kW by 2010 and \$30/kW in 2015, having a peak brake engine efficiency of 45%, and that meet or exceed emissions standards.

# 2010 Technology Goals: Manufacturing Base

- Material and manufacturing technologies for high volume production vehicles which enable/support the simultaneous attainment of:
  - 50% reduction in the weight of vehicle structure & subsystems;
  - Affordability; and
  - Increased use of recyclable/renewable materials.

# Performance Based Management

- Key metrics to be tracked annually.
- 2010 goals supported by targets and milestones detailed in EERE's Budget Request.
- All FreedomCAR work to be assessed annually against the R&D investment criteria developed as part of the President's Management Agenda.

# FreedomCAR

- Long-term effort
- Intermediate goals to assure progress